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ABSTRACT

This report is concerned with the language skills category of objectives of the Early Childhood Education (ECE) Program. The Illinois Test of Psycholinguistic Ability (ITPA) was the primary instrument used for evaluation of 3-, 4-, and 5-year-old children in three treatment groups: (1) mobile educational facility, TV, and paraprofessional, (2) TV and paraprofessional, and (3) TV only. A control group received no treatment. An overview of the ITPA is given, as well as separate descriptions of each of the ten subtests. The subtests overlap somewhat in the functions they measure, but cover the broad areas of auditory memory and acuity, verbal expression and grammar, syntax and transformations, and the ability to associate various auditory and visual stimuli. Statistical descriptions and inferences are presented for each subtest. An overall summary of the findings of the effects for the second year's programming in language development is presented. Trends reported indicate that the ECE Program is having an effect on a broad range of psycholinguistic abilities. Tables and figures comprise about one-half of the document. A summary of AEL Early Child Education program is available as PS 004 889. (Author/NH)

DETAILED ANALYSIS OF LANGUAGE DEVELOPMENT OF PRESCHOOL CHILDREN IN ECE PROGRAM

Technical Report No. 4

Division of Research and Evaluation
Appalachia Educational Laboratory
Charleston, West Virginia

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DETAILED ANALYSIS OF LANGUAGE DEVELOPMENT OF PRESCHOOL CHILDREN IN ECE PROGRAM*

Introduction

Originally, the objectives for the Early Childhood Education Program were divided into four major categories--motor activities, language skills, cognition, and orienting and attending skills.[1] This report is concerned with the language skills category of objectives.

One of the difficulties associated with evaluating language skills is the loose fit between available theoretical and operational definitions of language. Often language is not theoretically defined at all, and must be operationally defined by the particular instrument being used for evaluation purposes.

This procedure has been followed for the summative evaluation of language growth in the ECE program. Consequently, the theoretical model underlying the Illinois Test of Psycholinguistic Ability, the test used for language evaluation, is considered to be applicable to our ECE program. The definition of language used, therefore, was that of the authors of the ITPA.

The ITPA was a primary instrument in gathering data for the development of the Early Childhood curriculum objectives.[2] Since this is so, it was assumed that the ITPA would measure many of the language objectives of the program as it proceeded through its three year development cycle. The ITPA also has the advantage of being a nationally normed test and thus providing

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[1] Frank H. Hooper and William H. Marshall, The Initial Phase of a Preschool Curriculum Development Project (Charleston: Research and Information Center, 1968), p. 99.

[2] Ibid, pp. 76-89.

*This report was prepared by Brainard W. Hines of the Research and Evaluation Division of the Appalachia Educational Laboratory.

comparisons with a large sample of children outside of the AEL geographic area.

The text of this report will give an overview of the instrument, as well as separate descriptions of each of the subtests. Following this, statistical descriptions and inferences will be presented for each subtest. Finally an overall summary of our findings of the effects for the second year's programming in language development will be presented.

The Model of the ITPA

According to the authors of the ITPA, the purpose of the test is:

> To relate those functions whereby the intentions of one individual are transmitted (verbally or nonverbally) to another individual, and, reciprocally, functions whereby the environment or the intentions of another individual are received and interpreted. It attempts to interrelate the processes which take place, for example, when one person receives a message, interprets it, or becomes a source of a new signal to be transmitted. It deals with the psychological functions of the individual which operate in communication activities.[3]

It was hoped that the child would model his language behavior on the example provided by the television teacher, the paraprofessional, and the teacher on the mobile facility. Further, the ECE program does not stress verbal communication alone, but also attempts to involve the child in learning to express himself through gestures or pantomime. Thus, the model of language quoted above is closely applicable to the objectives of the ECE program.

The ITPA itself consists of ten subtests, each of which attempts to measure a different aspect of language skills, and those cognitive abilities which are related to language. These subtests overlap somewhat in the functions which they measure, but cover the broad areas of auditory memory

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[3]Samuel A. Kirk, James J. McCarthy, and Winifred D. Kirk, Examiners Manual, Illinois Test of Psycholinguistic Abilities, (Urbana: The Board of Trustees of the University of Illinois, 1968.)

and acuity, verbal expression and grammar, syntax and transformations, and the ability to associate various auditory and visual stimuli. A total score is compared for the test which attempts to give an overall picture of the individual's psycholinguistic functioning.

It should be noted that the ITPA's major function - that for which it was developed - is the identification and diagnosis of individual deficiencies in receptive or expressive language abilities. Its close congruence with many of the overall objectives of AEL's Early Childhood Education Program justify its use as a major evaluation instrument, but it must be considered as a secondary and less responsive indicator of differences among the treatment groups.

Methods of Analysis

The primary statistical technique used to analyze data from the ITPA was a three-way analysis of variance. This procedure involved measuring the significance of the effects of the four levels of treatment - (van + TV + paraprofessional), (TV + paraprofessional), (TV only), (no treatment); three levels of age (3, 4, and 5); and two levels of sex. The BMD series analysis of variance program with the correction routine for unequal n's was used. An analysis of covariance was also performed, using chronological age and Peabody Picture Vocabulary Test raw score as covariates. This procedure yielded little information beyond that obtained from the ANOVA, however.

Data were collected in June and September of 1970 from a sample of 273 children in the three treatment groups described above, as well as from 60 children in a comparison group located in Morgantown, West Virginia. A more complete description of the sampling technique used is presented in the introduction to this report.

Only raw scores were included for analysis of data from the ITPA. Scaled scores and derived scores were excluded because of the difficulties arising from comparing results from two different numerical measuring systems.

Description of ITPA Subtests and Data Analysis

ITPA Subtest 1, Auditory Reception

Auditory reception measures the ability of a child to derive meaning from verbally presented material. Since the receptive rather than the expressive process is being sampled, the response throughout is kept at the simple level of a "yes" or "no" or even a nod or shake of the head. The vocabulary becomes more and more difficult while the response remains at a two-year level. Similarly, the automatic function of determining meaning from syntax has been minimized by retaining only one sentence form. The test contains 50 short, direct questions printed in the manual. Typical items are: "Do dogs eat?" "Do dials yawn?" "Do carpenters kneel?" "Do wingless birds soar?"[4]

It seems likely that this subtest measures functions more complex than the ability to hear and understand simple questions. At the very least it is responsive to the vocabulary level of the individual, especially in the area of noun-verb relationships.

Table 4-1 indicates means and standard deviations for each sex and age cell within the four levels of treatment, and Table 4-2 shows the means by treatment groups without sex or age differentiation. These means and national norms according to the age of each treatment group are presented in Figure 4-1.

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[4] Ibid, p. 9.

TABLE 4-1

ITPA SUBTEST 1 MEANS, STANDARD DEVIATIONS,
AND NUMBERS OF SUBJECTS BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 16.89 SD = 3.52 N = 9	$\bar{x}$ = 16.22 SD = 5.09 N = 9	$\bar{x}$ = 17.54 SD = 6.84 N = 13	$\bar{x}$ = 15.38 SD = 5.58 N = 13
	F	$\bar{x}$ = 17.78 SD = 7.56 N = 9	$\bar{x}$ = 20.10 SD = 8.65 N = 10	$\bar{x}$ = 15.80 SD = 8.07 N = 10	$\bar{x}$ = 13.46 SD = 4.68 N = 13
4	M	$\bar{x}$ = 26.23 SD = 8.93 N = 13	$\bar{x}$ = 22.50 SD = 6.87 N = 8	$\bar{x}$ = 20.50 SD = 6.16 N = 8	$\bar{x}$ = 18.11 SD = 6.62 N = 9
	F	$\bar{x}$ = 22.40 SD = 4.14 N = 10	$\bar{x}$ = 19.40 SD = 3.66 N = 10	$\bar{x}$ = 20.23 SD = 5.63 N = 13	$\bar{x}$ = 24.40 SD = 8.51 N = 10

Combining all ages and both sexes results in an overall mean score for each group as also depicted in Figure 4-1.

TABLE 4-2

SUBTEST 1 MEANS, STANDARD DEVIATIONS, AND
SAMPLE SIZES BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 21.51 SD = 7.67 N = 40	$\bar{x}$ = 19.48 SD = 6.46 N = 44	$\bar{x}$ = 18.97 SD = 6.73 N = 44	$\bar{x}$ = 17.37 SD = 5.68 N = 45

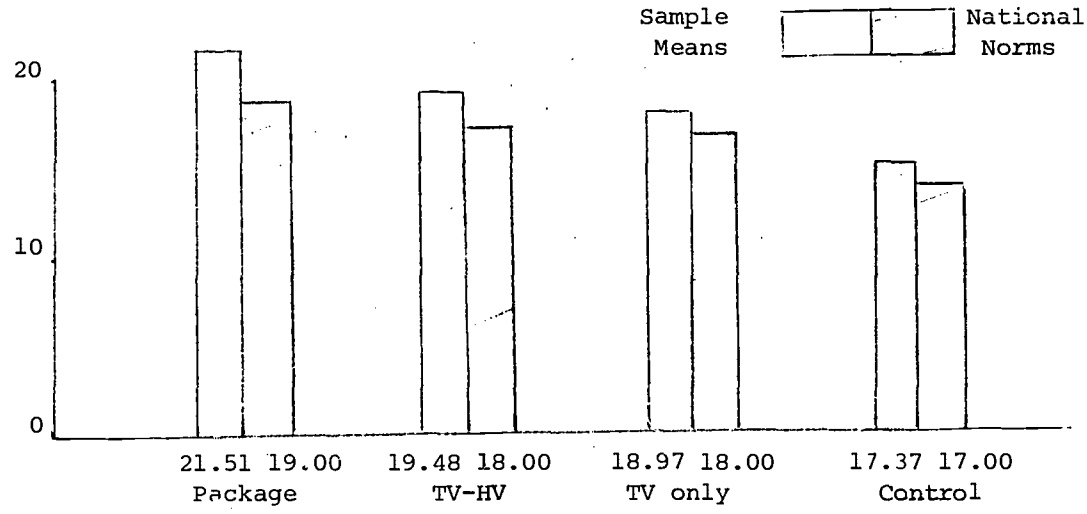


FIGURE 4-1

ITPA Subtest 1 (Auditory Reception) Mean Scores and National Norms by Treatment Groups

Analysis of variance for subtest 1 of the ITPA produced the results exhibited in Table 4-3.

TABLE 4-3

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 1

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.016	3	45.42182414	0.99	
J(sex)	.000	1	3.853257387	0.08	
K(age)	.110	1	950.9626239	20.78	P<.0005
IJ-INT	.016	3	45.76211651	1.00	
IK-INT	.013	3	37.52099342	0.82	
JK-INT	.001	1	7.293674101	0.16	
IJKINT	.045	3	129.9578338	2.84	P<.05
ERROR		150	45.77295830		

P = Package
H = TV-HV
T = TV only
C = Control Group

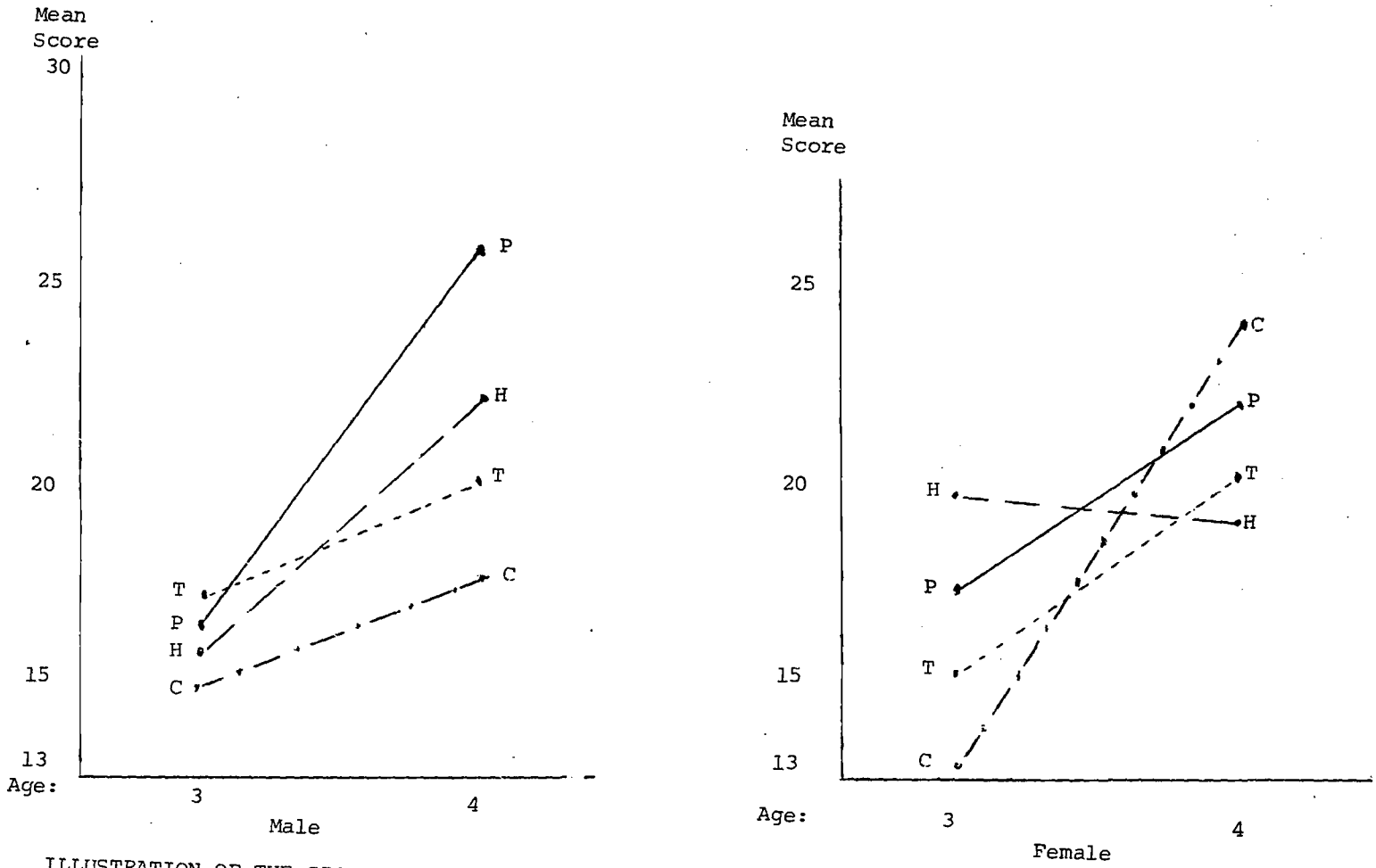


ILLUSTRATION OF THE SIGNIFICANT TREATMENT-AGE-SEX INTERACTION ON ITPA SUBTEST 1 (AUDITORY RECEPTION)

FIGURE 4-2

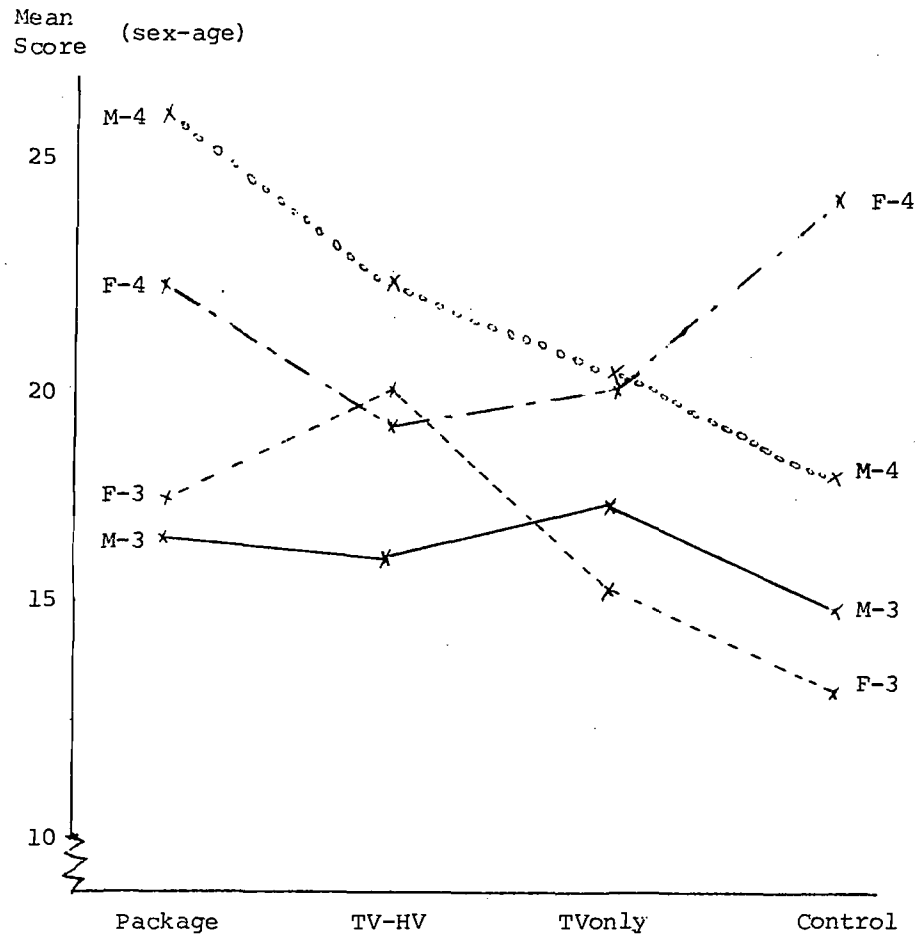


FIGURE 4-3

SEX-TREATMENT INTERACTION WITHIN AGE ON ITPA

As can be seen from the above, the differences between treatment groups were not statistically significant. However, the trend to relatively higher scores for children in the Package and TV-HV groups is consistently apparent throughout all of the subtests. This is indicative of the possibility of program effects which were not apparent in the statistical analysis. A treatment by age and sex interaction effect was also present on Subtest 1. Figure 4-2 illustrates this interaction graphically for males and females in each of the four treatment groups.

If we separate the four treatments into two groups using the presence or absence of the home visitor as a criterion for division, Figure 4-3 shows the superiority of the TV-HV and Package group over the TVonly and Control groups for four year old males and three year old females. It is possible that the home visitors reacted differently with the older females in each group. Also, the four year old females in the comparison group had the highest Peabody raw score which may account for their relatively superior performance on ITPA Subtest 1.

Figure 4-3 illustrates the sex-treatment interaction for both ages and sexes and all levels of treatment. Here again we can see the effectiveness of all three components on the four year old males and the lack of treatment effects for the three year old males. The females show a much more complex interaction which is particularly evident in the disparity of the scores of three and four year olds in the Control group.

Figures 4-4 and 4-5 show the correspondence of PPVT raw scores and ITPA Subtest 1 raw scores for each sex and age over the four treatment groups. Although there seems to be a fairly close relationship for the females, the males show little common variation. In both cases, however, the trend was in the same direction -- that is from higher scores for the Package group to relatively lower scores for the comparison and TVonly groups.

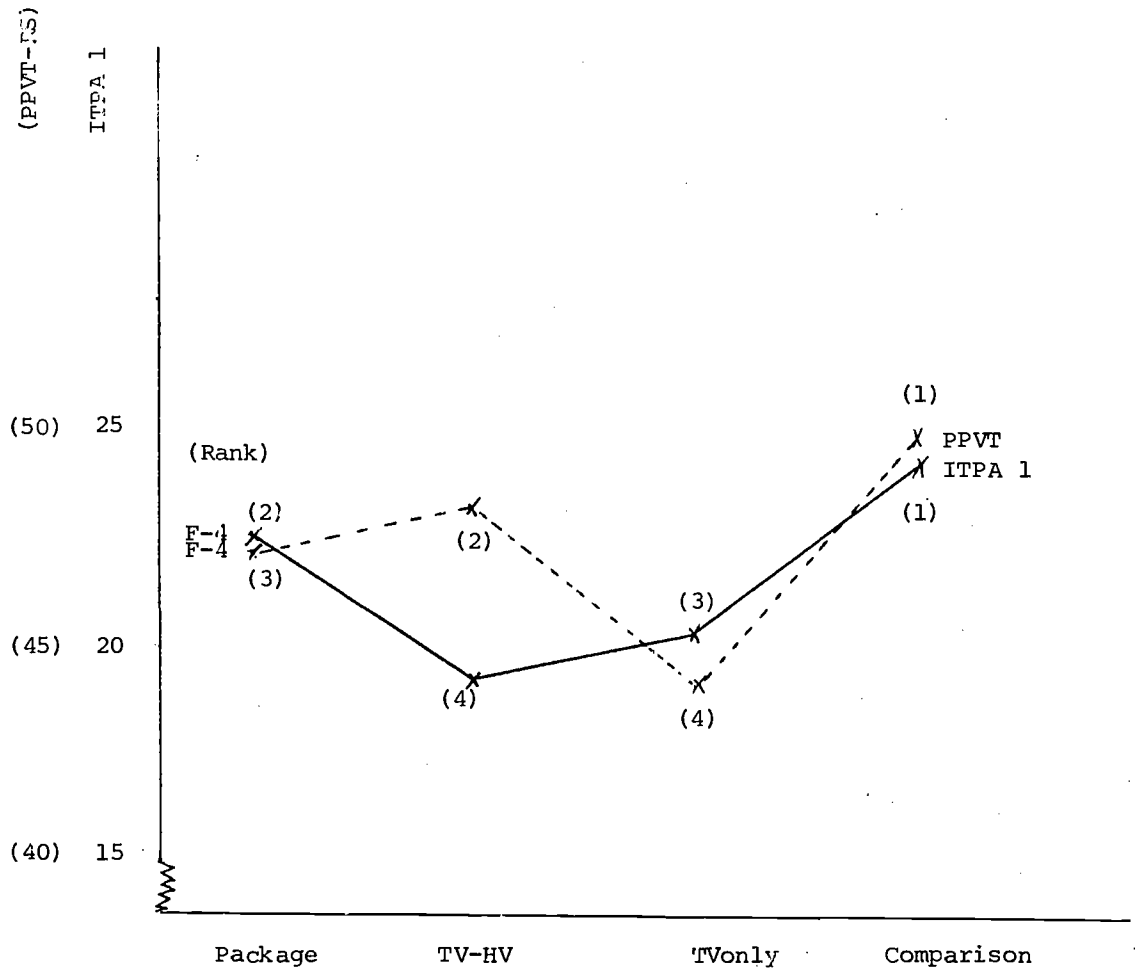
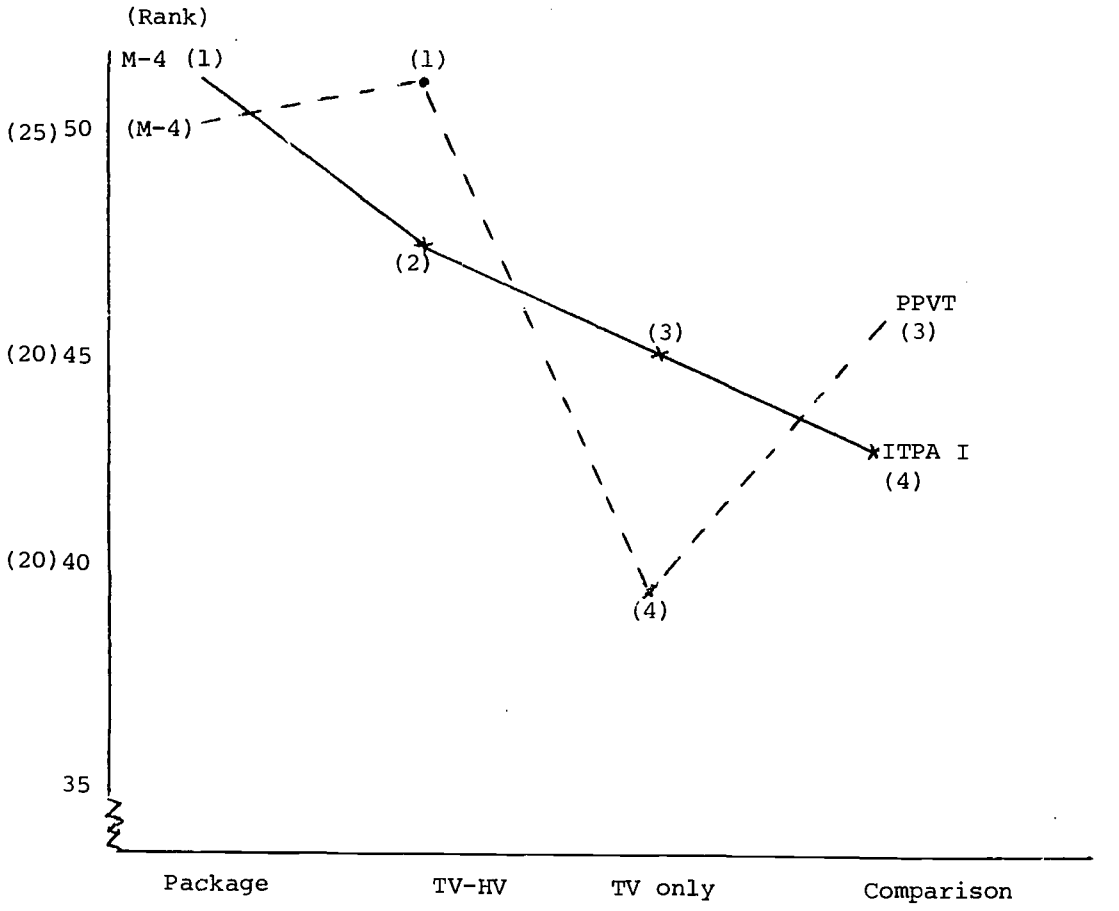


FIGURE 4-4

PPVT RAW MEAN SCORES OF FOUR YEAR OLD FEMALES SUPERIMPOSED ON THE ITPA SUBTEST ONE MEAN SCORES



PPVT RAW SCORES OF FOUR YEAR OLD MALES
SUPERIMPOSED ON THE ITPA SUBTEST ONE
MEAN SCORES

FIGURE 4-5

Since the ITPA is a measure of psycholinguistic development, significant increases in score with increases in age would provide evidence for the construct validity of the instrument. Subtest 1 did show such increases with age at a highly significant level ($P < .0005$), and thus does seem to be reflecting the growth of an ability over time.

ITPA Subtest 2, Visual Reception (Visual Decoding)

The visual reception test is comparable to the Auditory Reception Test but utilizes a different sense modality. It is a measure of the child's ability to gain meaning from visual symbols. In this test there are 40 picture items, each consisting of a stimulus picture on one page and four response pictures on a second page. The child is shown the stimulus picture for three seconds with the directions, "See this?" Then the page of response pictures is presented with the direction, "Find one here." The credited choice is the object or situation which is conceptually similar to the stimulus. The other choices include pictures with varying degrees of structural (rather than functional) similarity or pictures which are associated with the stimulus or with the acceptable choice.[5]

The title of this subtest is somewhat misleading, since functions more complex than visual acuity are involved. It is possible that this type of matching to sample task is dependent on the ability to make logical classifications, as well as simple visual reception.

Table 4-4 gives mean scores and standard deviations for each age and sex cell within the treatment and comparison groups, and Table 4-5 is the summary table.

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[5]Ibid., p. 10.

TABLE 4-4

ITPA SUBTEST 2 MEANS, STANDARD DEVIATIONS,
AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 12.67 SD = 3.67 N = 9	$\bar{x}$ = 11.78 SD = 5.19 N = 9	$\bar{x}$ = 11.85 SD = 5.49 N = 13	$\bar{x}$ = 10.15 SD = 5.80 N = 13
	F	$\bar{x}$ = 15.22 SD = 5.63 N = 9	$\bar{x}$ = 12.60 SD = 5.54 N = 10	$\bar{x}$ = 10.80 SD = 4.13 N = 10	$\bar{x}$ = 11.38 SD = 4.75 N = 13
4	M	$\bar{x}$ = 14.92 SD = 5.77 N = 13	$\bar{x}$ = 14.63 SD = 7.05 N = 8	$\bar{x}$ = 14.63 SD = 6.44 N = 8	$\bar{x}$ = 12.11 SD = 3.66 N = 9
	F	$\bar{x}$ = 14.80 SD = 4.08 N = 10	$\bar{x}$ = 11.60 SD = 5.15 N = 10	$\bar{x}$ = 13.38 SD = 4.56 N = 13	$\bar{x}$ = 14.30 SD = 7.75 N = 10

The results for all ages and both sexes are combined graphically in Figure 4-6 and compared with the national norms for this subtest.

TABLE 4-5

ITPA SUBTEST 2 MEAN SCORES AND NATIONAL
NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 14.33 SD = 4.95 N = 40	$\bar{x}$ = 12.57 SD = 5.59 N = 37	$\bar{x}$ = 12.56 SD = 5.13 N = 44	$\bar{x}$ = 11.82 SD = 5.68 N = 45

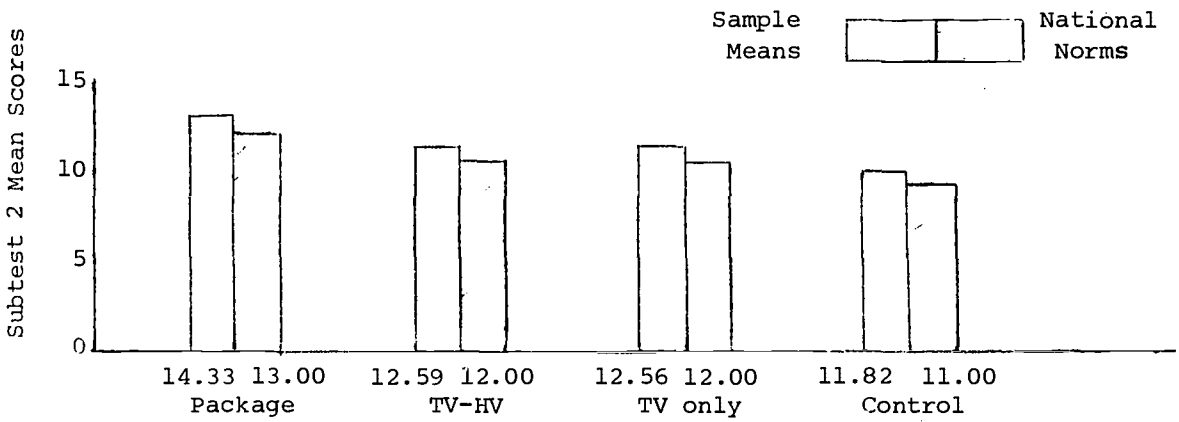

FIGURE 4-6

ITPA Subtest 2 (Visual Decoding) Mean Scores
and National Norms by Treatment Groups

As can be seen from the above, all groups of children scored slightly (but not significantly) above the national norms for this subtest. As in the case of ITPA Subtest 1, little evidence is present here for the intellectual or perceptual inferiority of children in Appalachia.

The analysis of variance table for Subtest 2 of the ITPA is presented in Table 4-6.

TABLE 4-6

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 2

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.015	3	24.88545805	0.82	NS
J(sex)	.000	1	0.0047166723	0.00	"
K(age)	.023	1	111.3115834	3.68	"
IJ-INT	.012	3	20.01997927	0.66	"
IK-INT	.007	3	10.88551579	0.36	"
JK-INT	.006	1	32.23751829	1.06	"
IJKINT	.010	3	16.53055900	0.54	"
ERROR		150	30.28172170		

The analysis of variance did not reveal any significant main or interaction effects for this subtest, but the trend to higher scores was evident for the package and TV-HV groups here as well.

The fact that no significant age effect appeared casts considerable doubt on the validity of this particular subtest in measuring a developmental aspect of the child's psycholinguistic ability.

ITPA Subtest 3, Auditory-Vocal Association

This measure taps the child's ability to relate concepts presented orally. In this test the requirements of the auditory receptive process and the vocal expressive process are minimal, while the organizing process of manipulating linguistic symbols in a meaningful way is tested by verbal analogies of increasing difficulty. A sentence completion technique is used, presenting one statement followed by an incomplete analogous statement, and allowing the child to complete the second statement appropriately. There are 42 orally presented analogies, such as, "I cut with a saw; I pound with a ____." "A dog has hair; a fish has _____."[6]

Subtest 3 probably is an overall measure of the child's ability to reason by analogies, as well as his general knowledge of objects and their functions in the environment.

Table 4-7 indicates mean scores and standard deviations for each age and sex cell with the four treatment groups.

TABLE 4-7

ITPA SUBTEST 3 MEANS, STANDARD DEVIATIONS,
AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV-only	Control
3	M	$\bar{x}$ = 14.56 SD = 5.08 N = 9	$\bar{x}$ = 12.89 SD = 6.79 N = 9	$\bar{x}$ = 12.46 SD = 6.79 N = 13	$\bar{x}$ = 11.08 SD = 6.21 N = 13
	F	$\bar{x}$ = 13.89 SD = 4.65 N = 9	$\bar{x}$ = 15.70 SD = 6.24 N = 10	$\bar{x}$ = 11.90 SD = 4.28 N = 10	$\bar{x}$ = 11.08 SD = 5.53 N = 13
4	M	$\bar{x}$ = 17.92 SD = 4.82 N = 13	$\bar{x}$ = 18.25 SD = 2.82 N = 8	$\bar{x}$ = 13.75 SD = 7.63 N = 8	$\bar{x}$ = 14.78 SD = 2.63 N = 9
	F	$\bar{x}$ = 18.50 SD = 4.50 N = 10	$\bar{x}$ = 15.50 SD = 6.69 N = 10	$\bar{x}$ = 16.54 SD = 6.60 N = 13	$\bar{x}$ = 16.60 SD = 5.19 N = 10

These results are combined in Table 4-8 and represented graphically in Figure 4-7. The latter includes the mean scores of the normative sample in this age group.

TABLE 4-8

ITPA SUBTEST 3 MEAN SCORES AND NATIONAL
NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 16.55 SD = 5.10 N = 40	$\bar{x}$ = 15.51 SD = 6.00 N = 37	$\bar{x}$ = 14.09 SD = 6.19 N = 44	$\bar{x}$ = 13.34 SD = 5.30 N = 45

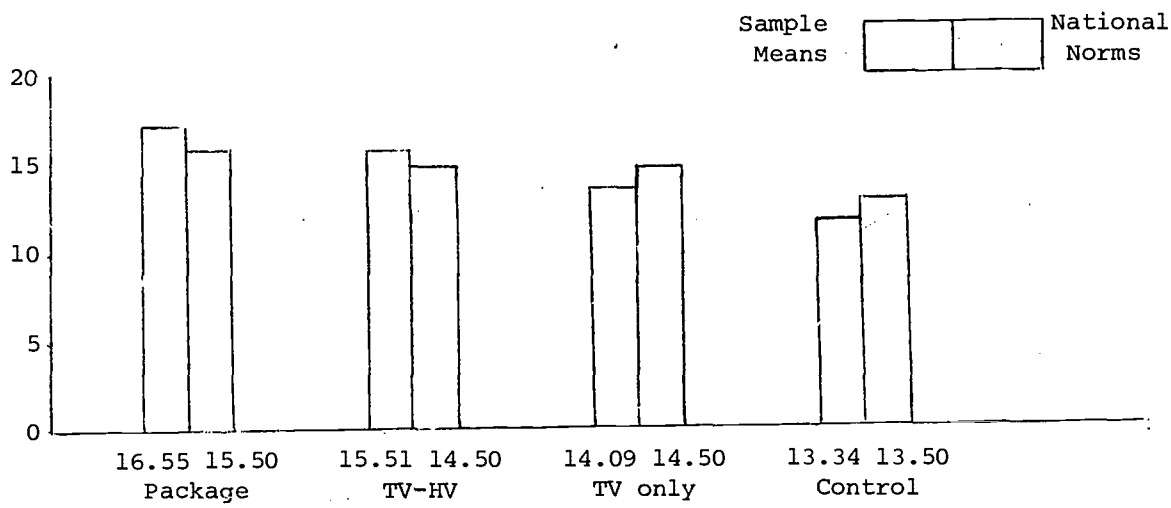

FIGURE 4- 7

ITPA SUBTEST 3 (AUDITORY-VOCAL ASSOCIATION)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Subtest 3 of the ITPA thus appears to continue the pattern which was evident throughout the balance of the instrument. Each group tends to score near or slightly above the national norms for that particular age, and there is a trend to higher scores for individuals exposed to the entire program package. Table 4-8 below presents a summary of the analysis of variance done on this subtest of the ITPA.

TABLE 4-9

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 3

Source	eta^2	D.F.	Mean Squares	F	P
I(trt)	.029	3	57.05480801	1.69	
J(sex)	.001	1	4.036195198	0.12	
K(age)	.080	1	467.7392341	13.82	P<.0005
IJ-INT	.004	3	7.625972229	0.22	
IK-INT	.004	3	8.089065620	0.24	
JK-INT	.000	1	0.9158882076	0.23	
IJKINT	.019	3	37.05652825	1.10	
ERROR		150	33.83088021		

As can be seen, from the above, neither treatment or sex produced main effects at a statistically significant level. Age was a highly significant ($P<.0005$) factor in the test, as was expected. It is of interest that no trend to higher scores for girls appears in this subtest, since even at this age traditional developmental theory gives females a slight edge in language development.

ITPA Subtest 4 (Visual-Motor Association)

The organizing process in this channel is tapped by a picture association test with which to assess the child's ability to relate concepts presented visually. The child is presented with a single stimulus picture surrounded by four optional pictures, one of which is associated with the stimulus picture. The child is asked, "What goes with this?" (pointing to the stimulus picture). "Which one of these?" (pointing to the four optional pictures). The child is to choose the one picture which is most closely related to the stimulus picture, such as a sock belonging with a shoe, or a hammer with a nail. The test is expanded at the upper level to provide visual analogies comparable to the auditory analogies. "If this goes with this" (pointing to each of a preliminary pair of pictures), "then what goes with this?" (pointing to the central picture as before). The test consists of 20 items of the simpler form and 22 visual analogies.[7]

Intuitively, this subtest seems very similar to Auditory Association (Subtest 3) and the relatively high correlation coefficient of .59 between the two measures provides empirical evidence for this similarity. In both cases the child's ability to reason by analogies and previous associations is being tapped.

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[7] Ibid, p. 10.

Table 4-10 indicates raw score, means, and standard deviations for ITPA Subtest 4, by age and treatment group categories.

TABLE 4-10

ITPA SUBTEST 4 MEANS, STANDARD DEVIATIONS, AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 13.33 SD = 3.43 N = 9	$\bar{x}$ = 11.33 SD = 8.25 N = 9	$\bar{x}$ = 11.46 SD = 4.24 N = 13	$\bar{x}$ = 10.69 SD = 7.64 N = 13
	F	$\bar{x}$ = 13.22 SD = 6.12 N = 9	$\bar{x}$ = 12.80 SD = 6.01 N = 10	$\bar{x}$ = 11.80 SD = 6.14 N = 10	$\bar{x}$ = 9.00 SD = 4.28 N = 13
4	M	$\bar{x}$ = 17.54 SD = 4.35 N = 13	$\bar{x}$ = 18.63 SD = 4.47 N = 8	$\bar{x}$ = 14.00 SD = 4.78 N = 8	$\bar{x}$ = 15.44 SD = 6.75 N = 9
		$\bar{x}$ = 15.90 SD = 2.60 N = 10	$\bar{x}$ = 16.40 SD = 4.77 N = 10	$\bar{x}$ = 15.00 SD = 4.50 N = 13	$\bar{x}$ = 15.00 SD = 6.72 N = 10

Combining both ages and sexes for each treatment group produces the following overall means (Table 4-11). Scores for children of comparable ages in the national normative sample are also presented in Figure 4-8.

TABLE 4-11

ITPA SUBTEST 4 MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 15.81 SD = 4.47 N = 40	$\bar{x}$ = 15.08 SD = 6.05 N = 31	$\bar{x}$ = 13.04 SD = 4.96 N = 44	$\bar{x}$ = 12.38 SD = 6.60 N = 45

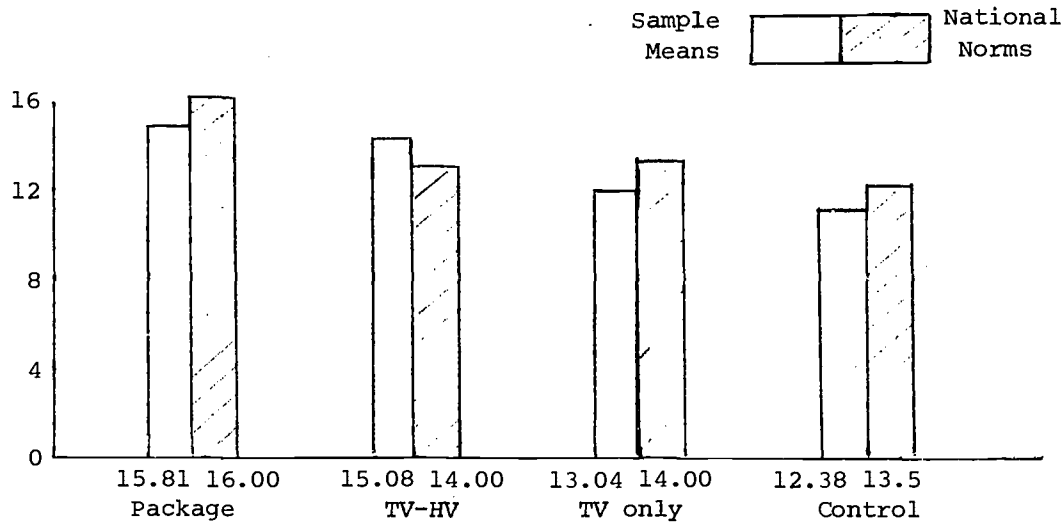

FIGURE 4-8

ITPA SUBTEST 4 (VISUAL-MOTOR ASSOCIATION)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Figure 4 indicates the trend to higher scores for children in the Package and TV-HV groups, when compared to national norms and to children who were not visited by the paraprofessional.

The results of the analysis of variance procedure for ITPA Subtest 4 raw scores are reproduced below in Table 4-12.

TABLE 4-12

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 4

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.026	3	49.45548115	1.58	
J(sex)	.004	1	23.59963049	0.75	
K(age)	.120	1	686.7694631	21.92	P<.0005
IJ-INT	.008	3	15.46676192	0.49	
IK-INT	.011	3	21.61335448	0.69	
JK-INT	.001	1	7.091971974	0.23	
IJKINT	.007	3	12.56053921	0.40	
ERROR		150	31.33603509		

Only age produced a significant main effect ($P<.0005$), but this lends validity to the hypothesized developmental nature of the subtest. In this case also, no significant male-female differences were apparent.

ITPA Subtest 5 (Verbal Expression)

The purpose of this test is to assess the ability of the child to express his own concepts vocally. The child is shown four familiar objects one at a time (ball, block, envelope, and a button) and is asked, "Tell me all about this." The score is the number of discrete, relevant, and approximately factual concepts expressed.[8]

This subtest undoubtedly reflects several factors other than verbal ability. The rapport with the examiner, the child's motivational level, and the amount of his previous experience with the objects are all highly important in the quantity of verbal response.

Means and standard deviations for Subtest 5 are indicated separately for each age group and sex in Table 4-13.

TABLE 4-13

ITPA SUBTEST 5 MEANS, STANDARD DEVIATIONS, AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 8.75 SD = 3.11 N = 8	$\bar{x}$ = 6.44 SD = 3.68 N = 9	$\bar{x}$ = 7.23 SD = 2.80 N = 13	$\bar{x}$ = 10.23 SD = 2.39 N = 13
	F	$\bar{x}$ = 8.75 SD = 2.19 N = 8	$\bar{x}$ = 9.80 SD = 2.74 N = 10	$\bar{x}$ = 5.00 SD = 31.6 N = 10	$\bar{x}$ = 9.00 SD = 4.10 N = 13
4	M	$\bar{x}$ = 10.62 SD = 3.28 N = 13	$\bar{x}$ = 11.88 SD = 6.90 N = 8	$\bar{x}$ = 9.13 SD = 3.91 N = 8	$\bar{x}$ = 9.89 SD = 2.76 N = 9
	F	$\bar{x}$ = 9.10 SD = 4.13 N = 11	$\bar{x}$ = 9.70 SD = 3.95 N = 10	$\bar{x}$ = 9.77 SD = 3.94 N = 13	$\bar{x}$ = 17.30 SD = 9.10 N = 10

[8] Ibid, p. 11.

Combining these scores for each treatment group produces the overall means indicates in Table 4-14 and Figure 4-9.

TABLE 4-14

ITPA SUBTEST 5 MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 9.69	$\bar{x}$ = 9.41	$\bar{x}$ = 8.00	$\bar{x}$ = 11.37
SD = 2.97	SD = 4.65	SD = 3.65	SD = 5.44
N = 40	N = 37	N = 44	N = 45

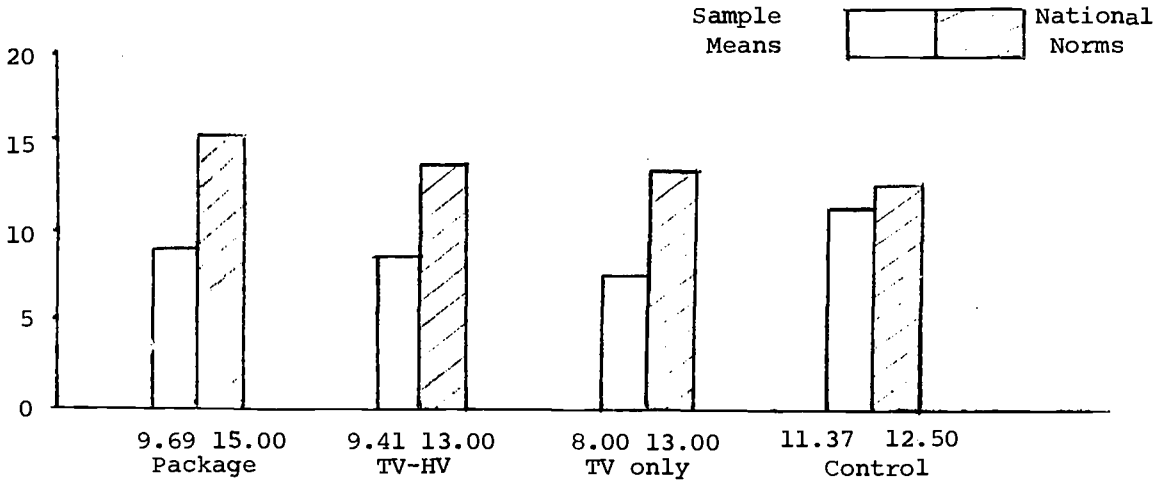

FIGURE 4-9

ITPA SUBTEST 5 (VERBAL EXPRESSION)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Several trends are evident in Subtest 5 which are unusual in the light of the results from the majority of the remaining subtests. First, children in the three treatment groups scored considerably lower than the national norms.

And, second, the comparison group scored significantly higher than the treatment groups. The analysis of variance summary table, presented below (Table 4-15) illustrates these inferences.

TABLE 4-15

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 5

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.056	3	95.05296202	3.76	P < .025
J(sex)	.017	1	84.74292314	3.36	
K(age)	.131	1	664.2441430	26.31	P < .0005
IJ-INT	.019	3	32.65865934	1.29	
IK-INT	.021	3	35.50957917	1.41	
JK-INT	.000	1	0.1256927372	0.00	
IJKINT	.006	3	10.53560919	0.42	
ERROR		150	25.25012769		

In this case, treatment and age produced significant effects on the raw score for Subtest 5 of the ITPA. A post-hoc comparison utilizing the Scheffe test, indicated the difference favoring the Control group in comparison to the TVonly group, produced a significant contribution to the treatment effect.

It is difficult to explain both the overall depression of scores for the three treatment groups and the comparative elevation of scores for children in the comparison group. It is possible that differences existed in tester training for this measure or that the comparison group differed in some aspects of home environment from the children exposed to the program components.

The most likely explanation is that the children in the three treatment groups are representative of the children in rural Appalachia in their expressive abilities, and that children in the comparison group more closely resemble the national norms in this respect.

ITPA Subtest 6 (Manual Expression)

Subtest 6 taps the child's ability to express ideas manually. This ability is assessed by gestural manipulation tests. In this test fifteen pictures of common objects are shown to the child one at a time and he is asked, "Show me what to do with a _____." The child is required to pantomime the appropriate action, such as dialing a telephone or playing a guitar.[9]

This subtest presumes acquaintance with the object shown to the child, and thus becomes a measure of vocabulary, as well as the ability to communicate nonverbally.

Table 4-16 indicates means and standard deviations for each age and sex group for ITPA Subtest 6 raw scores, and the combined scores are presented in Table 4-17.

TABLE 4-16

ITPA SUBTEST 6 MEANS, STANDARD DEVIATIONS,
AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 22.22 SD = 5.87 N = 9	$\bar{x}$ = 17.78 SD = 9.74 N = 9	$\bar{x}$ = 19.62 SD = 6.06 N = 13	$\bar{x}$ = 13.85 SD = 5.43 N = 13
	F	$\bar{x}$ = 18.89 SD = 5.37 N = 9	$\bar{x}$ = 20.40 SD = 6.00 N = 10	$\bar{x}$ = 17.40 SD = 4.43 N = 10	$\bar{x}$ = 14.23 SD = 5.05 N = 13
4	M	$\bar{x}$ = 26.23 SD = 6.25 N = 13	$\bar{x}$ = 21.88 SD = 8.18 N = 8	$\bar{x}$ = 20.88 SD = 4.19 N = 8	$\bar{x}$ = 15.44 SD = 7.55 N = 9
	F	$\bar{x}$ = 23.50 SD = 10.45 N = 10	$\bar{x}$ = 16.20 SD = 6.49 N = 10	$\bar{x}$ = 21.62 SD = 7.39 N = 13	$\bar{x}$ = 21.70 SD = 7.42 N = 10

As can be seen from this display, no single trend to higher scores was present for one sex throughout all four groups. However, it is interesting to note that four year old males tended to outscore females in the two groups

[9] Ibid, p. 11.

visited by the paraprofessional, while this trend is reversed in the two remaining groups.

TABLE 4-17

ITPA SUBTEST 6 MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 23.05	$\bar{x}$ = 17.49	$\bar{x}$ = 17.93	$\bar{x}$ = 17.16
SD = 7.65	SD = 7.11	SD = 5.71	SD = 7.90
N = 40	N = 37	N = 44	N = 45

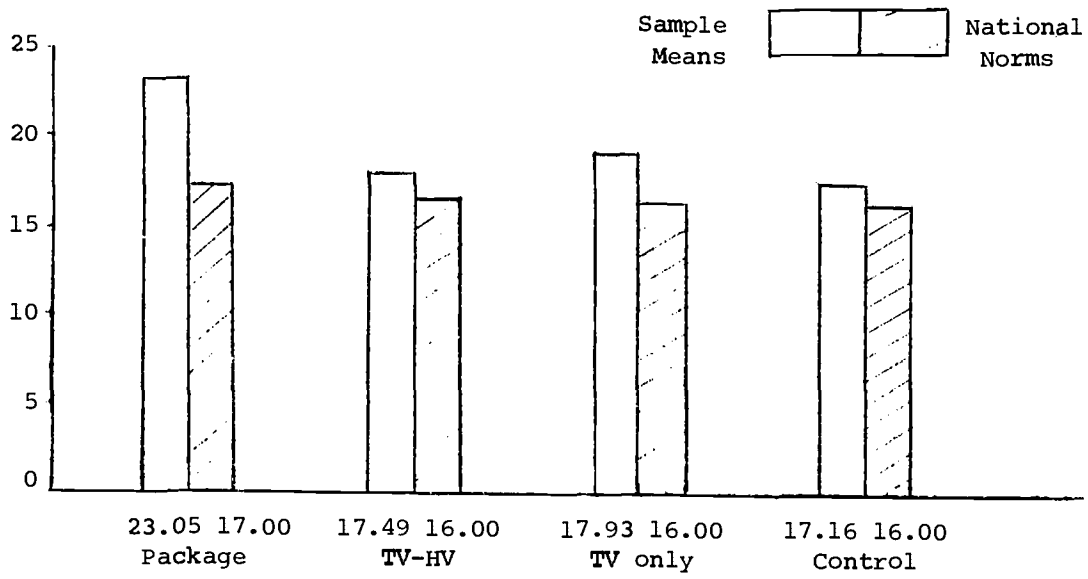

FIGURE 4- 10

ITPA SUBTEST 6 (MANUAL EXPRESSION)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Figure 4-10 indicates the large and significant ($P<.025$) difference between the treatment groups and the comparison. It also shows the relatively high

level of performance of these children when compared to the national norms. As an example, children in the Package group scored as highly as did individuals almost two years older in the national norms.

These inferences are clarified in Table 4-18 which presents a summary of the analysis of variance procedure for Subtest 6.

TABLE 4-18

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 6

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.078	3	229.0346593	4.80	P .025
J(sex)	.001	1	8.245994401	0.17	
K(age)	.040	1	350.3404769	7.33	P .0005
IJ-INT	.030	3	89.39034888	1.87	
IK-INT	.008	3	22.87959922	0.48	
JK-INT	.000	1	0.1807230504	0.00	
IJKINT	.025	3	71.91810046	1.50	
ERROR		150	47.76273181		

A Scheffe post-hoc comparison reveals that the significant (P .025) main effect of treatment favors the Package in comparison to the TV-HV, TVonly and Control groups. This is attributable to the emphasis placed on pantomime and "acting out" stories, by the van teacher and the paraprofessionals.

It is likely that purely verbal measures of intelligence (such as the PPVT) tend to underestimate the I.Q. level of rural and underprivileged children, as was pointed out by Rosenberg.[10] His views are given relevance to children in the Appalachian region by the findings of Hooper and Marshall,[11]

[10] Rosenberg, Leon - The J.H.P.T: Its Development and Current Status as a Measure of Intellectual Functioning. Prepublication Draft for the Disadvantaged Child, Vol. 2, 1969, Special Child Publications, Seattle, Washington.

[11] Hooper and Marshall, Op. Cit., p. 32.

who showed mean differences of nearly ten points in I.Q. between the PPVT and the more broadly based Stanford-Binet.

By circumventing the verbal channel of communication, the children are displaying more of their innate ability and knowledge of concepts by communicating by pantomime.

ITPA Subtest 7 (Grammatic Closure)

This subtest assesses the child's ability to make use of:

> The redundancies of oral language in acquiring automatic habits for handling syntax and grammatic inflections. In this test the conceptual difficulty is low, but the task elicits the child's ability to respond automatically to often repeated verbal expressions of standard American speech. The child comes to expect or predict grammatic form so that when part of an expression is presented he closes the gap by supplying the missing parts. The test measures the form rather than the content of the missing word, since the content is provided by the examiner.
>
> There are 33 orally presented items accompanied by pictures which portray the content of the verbal expression. The pictures are included to avoid contaminating the test with difficulty in the receptive process. Each verbal item consists of a complete statement followed by an incomplete statement to be finished by the child. The examiner points to the appropriate picture as he reads the given statements; for example: "Here is a dog; here are _____."[12]

Essentially, Subtest 7 measures the ability to follow the conventional rules of grammar and make single-plural and possessive transformations. Pilot data gathered by Hooper and Marshall indicate that children in the Appalachian region showed large defects in this area of functioning, as did children in other "deprived" regions.[13]

Mean raw scores and standard deviations for age and sex cells on ITPA Subtest 7 are presented in Table 4-19, and means for combined groups are given in Table 4-20.

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[12] Kirk and McCarthy, Op. Cit., p.11.

[13] Hooper and Marshall, Op. Cit., p. 89.

TABLE 4-19

ITPA SUBTEST 7 MEANS, STANDARD DEVIATIONS,
AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 9.11 SD = 5.11 N = 9	$\bar{x}$ = 9.56 SD = 5.27 N = 9	$\bar{x}$ = 8.00 SD = 4.28 N = 13	$\bar{x}$ = 9.62 SD = 4.03 N = 13.
	F	$\bar{x}$ = 9.44 SD = 5.75 N = 9	$\bar{x}$ = 12.20 SD = 4.66 N = 10	$\bar{x}$ = 8.60 SD = 3.37 N = 10	$\bar{x}$ = 7.69 SD = 3.77 N = 13
4	M	$\bar{x}$ = 13.92 SD = 5.60 N = 13	$\bar{x}$ = 14.75 SD = 5.39 N = 8	$\bar{x}$ = 7.25 SD = 3.01 N = 8	$\bar{x}$ = 12.11 SD = 3.30 N = 9
	F	$\bar{x}$ = 11.10 SD = 4.20 N = 10	$\bar{x}$ = 12.40 SD = 4.95 N = 10	$\bar{x}$ = 12.15 SD = 7.72 N = 13	$\bar{x}$ = 14.40 SD = 5.32 N = 10

These mean scores are combined and graphically presented in Figure 4-11 along with the means of children of comparable age in the national normative sample.

TABLE 4-20

ITPA SUBTEST 7 MEAN SCORES AND NATIONAL
NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 11.28 SD = 5.51 N = 40	$\bar{x}$ = 12.16 SD = 6.16 N = 37	$\bar{x}$ = 9.44 SD = 5.30 N = 44	$\bar{x}$ = 10.86 SD = 4.52 N = 45

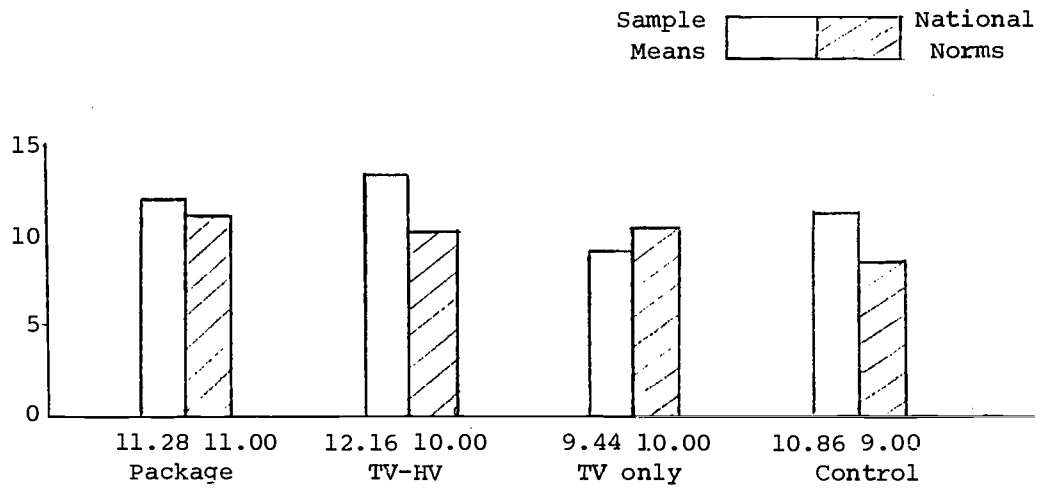

FIGURE 4-11

ITPA SUBTEST 7 (GRAMMATIC CLOSURE)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Inspection of the relative height of these figures indicates that Subtest 7 provides another example of the ECE sample group exceeding the national norms. The lower scores for the TV only group is consistent with the score pattern evident throughout most of the battery.

Table 4-21 provides further evidence for these differences through a summary of the analysis of variance procedure which was applied to the raw scores from Subtest 7.

TABLE 4-21

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 7

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.045	3	70.03365775	2.80	P<.05
J(sex)	.001	1	5.944823235	0.23	
K(age)	.071	1	328.6685537	13.12	P<.0005
IJ-INT	.021	3	31.83897364	1.27	
IK-INT	.012	3	18.66772990	0.74	
JK-INT	.000	1	0.7043026914	0.03	
IJKINT	.044	3	68.30950624	2.73	P<.05
ERROR		150	25.04687827		

P = Package
H = TV-HV
T - TV only
C - Control Group

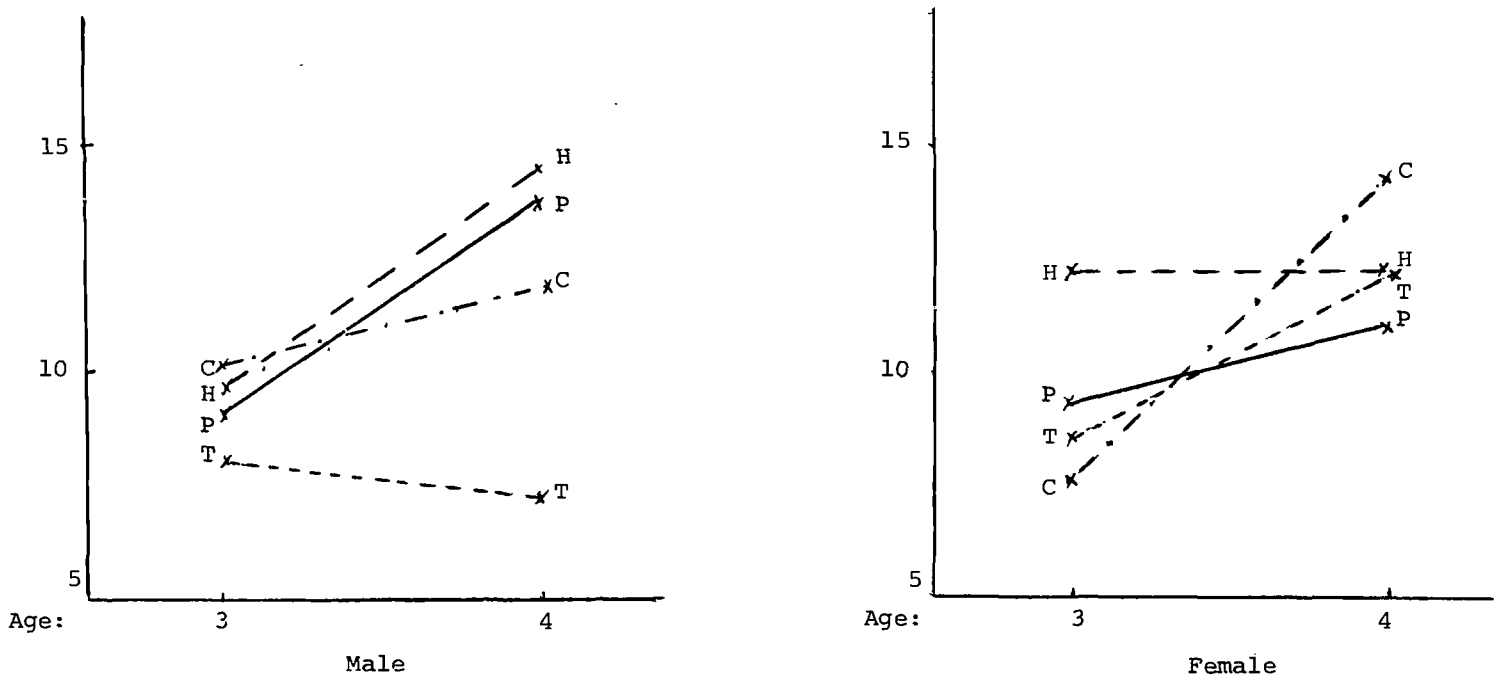

FIGURE 4-12

ILLUSTRATION OF THE SIGNIFICANT TREATMENT-AGE-SEX INTERACTION ON ITPA SUBTEST 7 (GRAMMATIC CLOSURE)

The highly significant ($P < .005$) age effect is expected throughout the ITPA. A post-hoc comparison did not reveal any single pair of comparisons which were significant. However, the main effect of treatment which is evident seems to result from the disparity between the TV-HV and Package groups when compared to the TVonly and Control groups. Since one of the main purposes of the paraprofessional is to provide a model for the child's language behavior, it is likely that she has had an effect in raising these scores.

A significant age, sex and treatment interaction is present in the program's effects on grammar as measured by Subtest 7. Figure 4-10 illustrates this interaction graphically for both males and females in each of the four treatment groups. As for Subtest 1 the home visitor group four year old males seem to be showing the greatest treatment effect. The home visitor group females do not show increases with age for this particular measure. This graphical representation clearly indicates the program's differential effectiveness on age-sex combinations.

ITPA Subtest 8 (Visual Closure)

This test is designed to measure:

> The child's ability to identify a common object from an incomplete visual presentation. There are four scenes, presented separately, each containing 14 or 15 examples of a specified object. The objects are seen in varying degrees of concealment. The child is asked to see how quickly he can point to all examples of a particular object within a time limit of 30 seconds for each scene.[14]

This measure probably involves few central mediating processes (cognition) and provides an estimate of the child's motivation and attentiveness, as well as his visual acuity.

Table 4-22 indicates raw score means obtained by each age and sex subgrouping on ITPA Subtest 8. Combined score means are presented as Table 4-23, and representing them graphically produces Figure 4-13, in which national norms are also presented.

[14] Ibid., p. 12.

TABLE 4-22

ITPA SUBTEST 8 MEANS, STANDARD DEVIATIONS,
AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 12.00 SD = 2.29 N = 9	$\bar{x}$ = 9.89 SD = 5.16 N = 9	$\bar{x}$ = 11.38 SD = 3.66 N = 13	$\bar{x}$ = 9.77 SD = 3.94 N = 13
	F	$\bar{x}$ = 8.33 SD = 3.04 N = 9	$\bar{x}$ = 9.80 SD = 4.18 N = 10	$\bar{x}$ = 11.60 SD = 4.25 N = 10	$\bar{x}$ = 11.62 SD = 5.03 N = 13
4	M	$\bar{x}$ = 14.00 SD = 4.04 N = 13	$\bar{x}$ = 13.25 SD = 4.17 N = 8	$\bar{x}$ = 13.88 SD = 3.36 N = 8	$\bar{x}$ = 15.22 SD = 9.98 N = 9
	F	$\bar{x}$ = 15.80 SD = 2.74 N = 10	$\bar{x}$ = 14.70 SD = 7.06 N = 10	$\bar{x}$ = 14.62 SD = 5.11 N = 13	$\bar{x}$ = 20.60 SD = 7.88 N = 10

TABLE 4-23

ITPA SUBTEST 8 MEAN SCORES AND NATIONAL
NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 12.89 SD = 4.16 N = 40	$\bar{x}$ = 11.89 SD = 5.56 N = 37	$\bar{x}$ = 12.84 SD = 4.33 N = 44	$\bar{x}$ = 13.80 SD = 8.69 N = 45

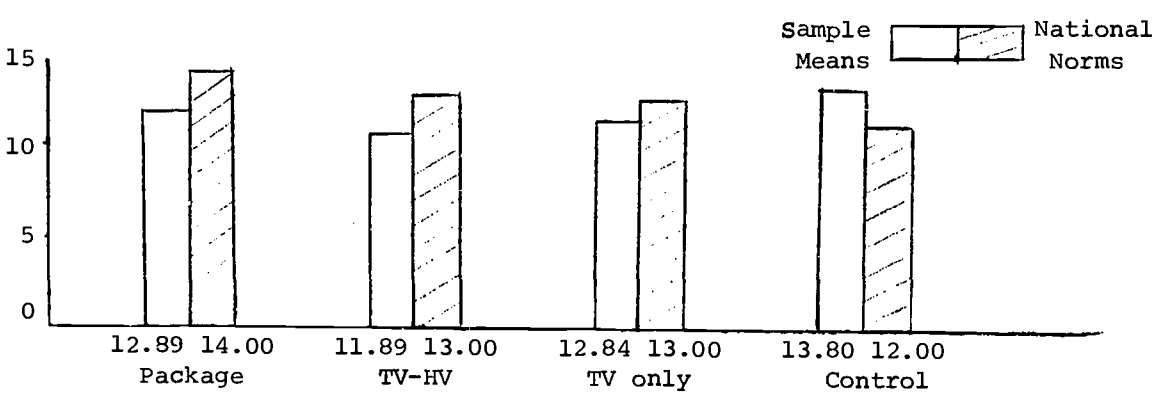

FIGURE 4-13

ITPA SUBTEST 8 (VISUAL CLOSURE)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

The fact that all treatment groups scores at essentially the same level, provides evidence that these children are functioning at the same level of motivation and visual discrimination.

Table 4-24 below presents the analysis of variance data for Subtest 8.

TABLE 4-24

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 8

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.026	3	47.22397700	1.73	
J(sex)	.004	1	20.90570617	0.76	
K(age)	.150	1	819.8685021	30.00	P<.0005
IJ-INT	.029	3	52.22436931	1.91	
IK-INT	.021	3	38.90092937	1.42	
JK-INT	.012	1	63.64592392	2.33	
IJKINT	.004	3	8.264058789	0.30	
ERROR		150	27.33185574		

No treatment or sex effects were evident on Subtest 8 but age proved to be a major factor in causing score differences. As has been mentioned previously, this provides validation of the developmental nature of the instrument.

ITPA Subtest 9 (Auditory Sequential Memory)

The purpose of this test is to:

> Assess the child's ability to reproduce from memory sequences of digits increasing in length from two to eight digits. The test differs from the digit repetition task of the Stanford-Binet or the WISC in that the digits are presented at the rate of two per second instead of one per second and in that the child is allowed a second trial of each sequence if he fails on the first presentation. He receives more credit for a success on the first than on the second trial. A more rapid presentation makes the task easier, which is necessary for the two and the three year old children. [15]

[15] Ibid., p. 12-13.

Although the format of this subtest differs slightly from that used on the Wechsler scales or the Stanford-Binet, it duplicates the type of function measured on those instruments. That is, it estimates the child's ability to use immediate recall of recently learned auditory sequences. This type of measure does not involve much cognitive (analytic) activity but is sensitive to outside distractions and anxiety level.

Table 4-25 presents means, standard deviations, and numbers of subjects for Subtest 9. The combined means are given in Table 4-26.

TABLE 4-25

ITPA SUBTEST 9 MEANS, STANDARD DEVIATIONS, AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 17.78 SD = N = 9	$\bar{x}$ = 14.89 SD = 8.39 N = 9	$\bar{x}$ = 16.92 SD = 8.12 N = 13	$\bar{x}$ = 17.46 SD = 7.69 N = 13
	F	$\bar{x}$ = 13.44 SD = 7.75 N = 9	$\bar{x}$ = 16.90 SD = 5.51 N = 10	$\bar{x}$ = 17.40 SD = 6.95 N = 10	$\bar{x}$ = 13.85 SD = 9.67 N = 13
4	M	$\bar{x}$ = 21.23 SD = 8.56 N = 13	$\bar{x}$ = 20.50 SD = 7.50 N = 8	$\bar{x}$ = 18.25 SD = 10.81 N = 8	$\bar{x}$ = 18.11 SD = 7.57 N = 9
	F	$\bar{x}$ = 19.70 SD = 2.95 N = 10	$\bar{x}$ = 21.10 SD = 6.72 N = 10	$\bar{x}$ = 19.77 SD = 7.62 N = 13	$\bar{x}$ = 18.40 SD = 7.63 N = 10

The scores are also combined in Figure 4-14 which also presents graphical representation of normative scores for this subtest.

TABLE 4-26

ITPA SUBTEST 9 MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 18.51	$\bar{x}$ = 18.83	$\bar{x}$ = 18.53	$\bar{x}$ = 17.14
SD = 7.24	SD = 6.62	SD = 7.65	SD = 7.90
N = 40	N = 37	N = 44	N = 45

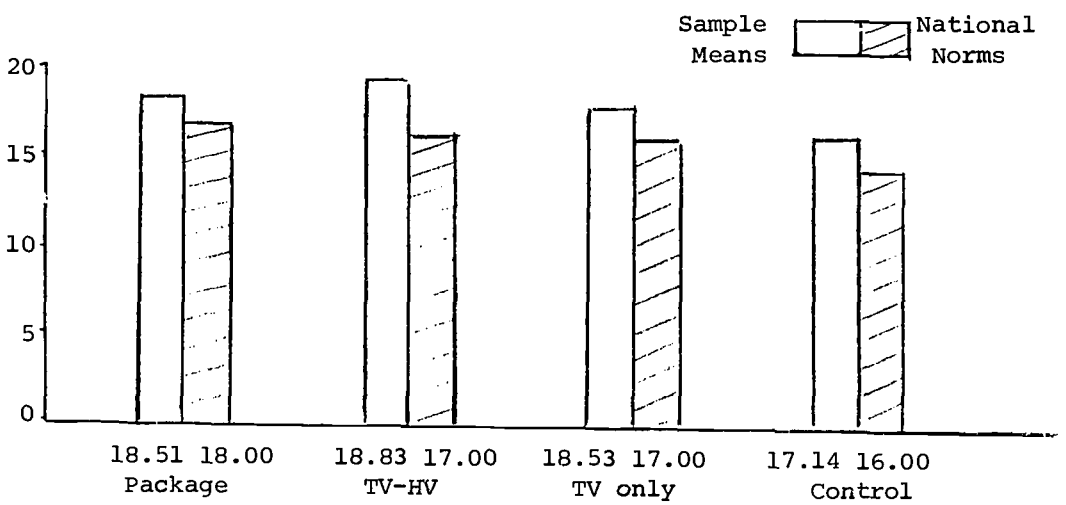

FIGURE 4-14

ITPA SUBTEST 9 (AUDITORY SEQUENTIAL MEMORY) MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

As in the previous subtest (ITPA 8) the children in all groups seem to be equivalent in terms of this relatively "automatic" area of functioning. They also score uniformly above the national norms for their age.

Table 4-27 presents a summary of the analysis of variance for the raw scores on Subtest 9.

TABLE 4-27

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 9

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.005	3	15.55132626	0.25	
J(sex)	.002	1	23.79503270	0.39	
K(age)	.045	1	447.0387564	7.27	P<.01
IJ-INT	.016	3	54.92008549	0.89	
IK-INT	.006	3	18.66067575	0.30	
JK-INT	.001	1	11.78228939	0.19	
IJKINT	.004	3	12.03784634	0.20	
ERROR		150	61.46082271		

In this case, only one major effect was evident, that for age, which is expected throughout the instrument.

The uniform trend to scores slightly above the norm provides evidence for the good quality of rapport which was present during testing. If the examiner had provoked high levels of anxiety, it is likely that these scores would have been substantially reduced.

ITPA Subtest 10 (Visual Sequential Memory)

According to the authors:

> This test assesses the child's ability to reproduce sequences of nonmeaningful figures from memory. A child is shown each sequence of figures for five seconds and then is asked to put corresponding chips of figures in the same order. Here again the child is allowed two trials on each sequence when the first attempt is unsuccessful. The sequence increases in length from two to eight figures.[16]

Subtest 10 measures the same short-term memory as the previous subtest, but does so in terms of visual configurations, rather than auditory sequencing. It is subject to the same influences and intervening factors as that of Subtest 9.

[16] Ibid., p. 13.

Means, standard deviations, and numbers of subjects are presented in Table 4-28, which includes each age and sex cell in the four groups analyzed. Table 4-29 is a presentation of means for each treatment group, and combining these scores and comparing them graphically with the normative sample for the ITPA produces Figure 4-15.

TABLE 4-28

ITPA SUBTEST 10 MEANS, STANDARD DEVIATIONS, AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 7.00 SD = 3.77 N = 9	$\bar{x}$ = 7.44 SD = 3.81 N = 9	$\bar{x}$ = 6.85 SD = 3.91 N = 13	$\bar{x}$ = 4.85 SD = 3.91 N = 13
	F	$\bar{x}$ = 8.11 SD = 5.04 N = 13	$\bar{x}$ = 10.20 SD = 4.16 N = 10	$\bar{x}$ = 6.20 SD = 4.05 N = 10	$\bar{x}$ = 8.15 SD = 6.71 N = 13
4	M	$\bar{x}$ = 9.54 SD = 5.04 N = 13	$\bar{x}$ = 11.50 SD = 2.67 N = 8	$\bar{x}$ = 9.13 SD = 5.49 N = 8	$\bar{x}$ = 12.11 SD = 7.74 N = 9
	F	$\bar{x}$ = 9.40 SD = 2.67 N = 10	$\bar{x}$ = 16.10 SD = 7.46 N = 10	$\bar{x}$ = 9.92 SD = 3.73 N = 13	$\bar{x}$ = 13.30 SD = 6.36 N = 10

TABLE 4-29

ITPA SUBTEST 10 MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 8.94 SD = 4.20 N = 40	$\bar{x}$ = 11.72 SD = 5.52 N = 37	$\bar{x}$ = 9.05 SD = 3.45 N = 44	$\bar{x}$ = 9.55 SD = 6.72 N = 45

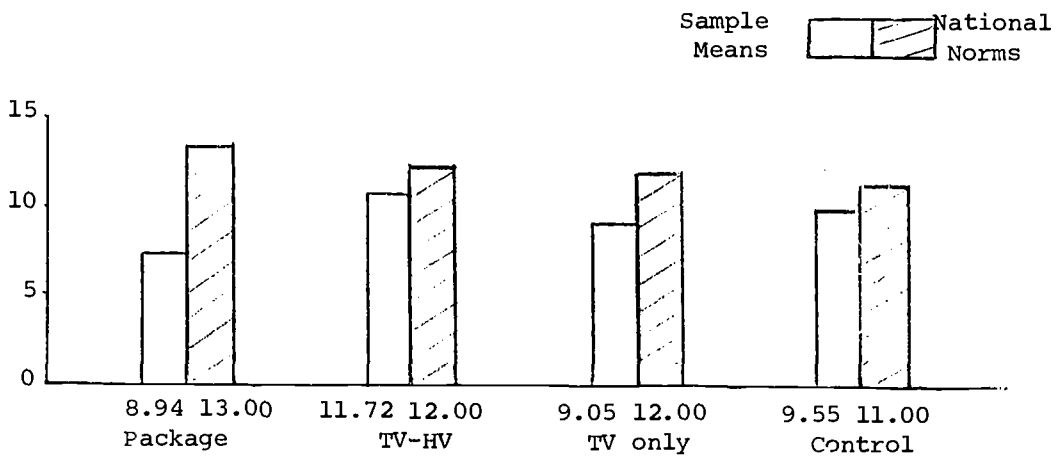

FIGURE 4-15

ITPA SUBTEST 10 (VISUAL SEQUENTIAL MEMORY)
MEAN SCORES AND NATIONAL NORMS BY TREATMENT GROUPS

The considerable discrepancy between national norms and the ECE sample is evident in the figure above. It is extremely difficult to present explanations which could account for this apparent deficit in visual memory, and is particularly difficult in light of the sample group's performance on the remainder of the test battery. The most likely hypothesis is that this subtest is perhaps the most difficult to administer and score of the entire battery, and that a significant examiner factor reduced the overall scores of the group.

The analysis of variance summary table is presented for Subtest 10 in Table 4-30.

TABLE 4-30

ANALYSIS OF VARIANCE TABLE FOR ITPA SUBTEST 10

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.056	3	95.05296202	3.76	P .025
J(sex)	.017	1	84.74292314	3.36	
K(age)	.131	1	664.2441430	26.31	P .00
IJ-INT	.019	3	32.65865934	1.29	
IK-INT	.021	3	35.50957917	1.41	
JK-INT	.000	1	0.1256927372	0.00	
IJKINT	.006	3	10.53560919	0.41	
ERROR		150	25.25012769		

The large and significant effects of treatment and sex are equally difficult to explain. A post-hoc comparison of group means did not indicate any single pair of significant differences. Although age effects are expected for all measures of developmental factors, it is not likely that depressed scores for the Package group are due to pure treatment effects.

ITPA Total Raw Score

The total score for all ten subtests is presented below in Table 4-31 for each age and sex cell of the four treatment groups.

TABLE 4-31

ITPA TOTAL RAW SCORE MEANS, STANDARD DEVIATIONS AND SAMPLE SIZES BY AGE AND SEX WITHIN TREATMENT GROUPS

Age	Sex	Package	TV-HV	TV only	Control
3	M	$\bar{x}$ = 132.88 SD = 26.90 N = 8	$\bar{x}$ = 118.22 SD = 45.54 N = 9	$\bar{x}$ = 123.31 SD = 34.78 N = 13	$\bar{x}$ = 113.08 SD = 33.72 N = 13
	F	$\bar{x}$ = 124.13 SD = 3.63 N = 8	$\bar{x}$ = 140.50 SD = 38.02 N = 10	$\bar{x}$ = 116.50 SD = 35.61 N = 10	$\bar{x}$ = 109.15 SD = 29.91 N = 13
4	M	$\bar{x}$ = 172.15 SD = 27.36 N = 13	$\bar{x}$ = 167.75 SD = 39.08 N = 8	$\bar{x}$ = 141.38 SD = 38.62 N = 8	$\bar{x}$ = 143.33 SD = 35.27 N = 9
	F	$\bar{x}$ = 160.10 SD = 23.59 N = 10	$\bar{x}$ = 155.10 SD = 38.69 N = 10	$\bar{x}$ = 153.00 SD = 34.24 N = 13	$\bar{x}$ = 176.00 SD = 51.05 N = 10

Figure 4-16 presents a combination of these mean scores for each treatment group along with standard deviations and total numbers of subjects. No normative total score was available for comparison with a national sample, but it can be safely assumed that the total raw score follows the same pattern as the individual subtests. That is, children throughout the four groups scored near or slightly above national norms with few exceptions.

TABLE 4-32

ITPA TOTAL RAW SCORE MEAN SCORES AND
NATIONAL NORMS BY TREATMENT GROUPS

Package	TV-HV	TV only	Control
$\bar{x}$ = 151.15	$\bar{x}$ = 144.92	$\bar{x}$ = 133.81	$\bar{x}$ = 131.98
SD = 33.76	SD = 42.68	SD = 37.38	SD = 45.16
N = 40	N = 37	N = 44	N = 45

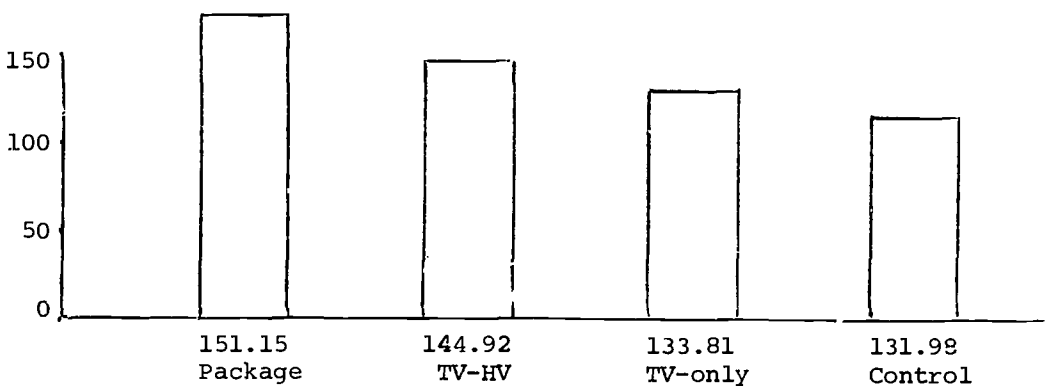

FIGURE 4-16

ITPA TOTAL MEAN SCORES BY TREATMENT GROUPS

The differences which appear in the overall raw score means are not statistically significant. However, the continuing trend which they represent, which is evident throughout the ten ITPA subtests, is increasingly indicative of program effects which are present but not being precisely tapped.

Table 4-33 presents the summary of the analysis of variance procedure which was performed on the total ITPA raw score.

TABLE 4-33

ANALYSIS OF VARIANCE TABLE FOR ITPA TOTAL RAW SCORE

Source	eta^2	D.F.	Mean Square	F	P
I(trt)	.015	3	1386.633021	0.97	
J(sex)	.000	1	38.37488222	0.03	
K(age)	.170	1	47848.98859	33.60	P<.0005
IJ-INT	.019	3	1815.543056	1.28	
IK-INT	.010	3	975.6609285	0.68	
JK-INT	.000	1	3.129962914	0.00	
IJKINT	.028	3	2686.089878	1.89	
ERROR		150	1423.895898		

As is evident from the table above, only age produced a significant main effect on the ITPA total test. While this in itself does not validate the instrument, it does provide evidence for the developmental nature of the test, and for the content validity of the other significant effects which were uncovered.

Summary of Results

Although the ITPA did not correspond closely to AEL's Early Childhood Education Program curriculum objectives, it was decided to use the ITPA as a data gathering instrument which would indirectly measure program effects.

All but one of the ten subtests showed significant increases with age, a fact which lends credibility to the developmental nature of the test. Surprisingly, few significant sex effects were present despite the fact that traditional developmental theory places girls of this age (3-4 1/2 years) slightly ahead of their male counterparts in language skills. Also, the majority of the subtests showed all of the sample groups to be scoring near or above national norms. This finding runs contrary to the view that Appalachian children are behind their age peers in the rest of the nation in terms of language development.

One significant exception to the above occurred in the results of Subtest 5, which measures expressive language ability. Here, all the groups scored well below the national norms, and the TV only group produced the lowest scores of all the samples. Although no empirical evidence was available to explain this trend, it seems likely that a rural Appalachian environment has a great effect on the child's ability to express himself verbally in a relatively unstructured situation. Since the TV only group tended to have a more rural environment, and differed only in this respect from the other treatment groups' socio-economic status, this is the most likely explanation for their differing performance.

Other significant treatment effects indicated that children who received all three program components were more able to express themselves nonverbally (by gestures and pantomime) than were children in the comparison group, and that the TV-HV group was more able to make correct grammatical transformations than the TV only group.

Although only a few measures included in the ITPA showed significant treatment effects, eight of the ten subtests administered and the total test raw score showed a trend to increasingly higher scores for children who

received more of the program components. The consistency of these trends indicates that the Early Childhood Education Program is having an effect on a broad range of psycholinguistic abilities.